HEAT-DISSIPATING DEVICE

FIELD OF THE INVENTION

The present invention is related to a heat-dissipating device, particularly to a heat-dissipating device capable of cooperating with a cross-flow type fan, by which the significantly raised effect of heat-dissipation of a heat-conductive base plate.

BACKGROUND

Accordingly, as the semi-conductor process progresses increasingly, the volume of the chip and processor used in current electronic apparatuses or computer systems, such as central processing units (CPUs) and another electronic devices in the computer systems, may become smaller and smaller, whereas the working performance and the computation speed is relatively doubled. Due to the accelerated data processing speed, the accompanying working temperature may be just raised without dropping. Therefore, for the purpose of avoiding the degraded computation efficiency and even the damage resulted from the super-high working temperature, the heat-dissipating device is required for the CPUs and another electronic devices in order to effectively lower the high working temperature of the latter.

Generally, a traditional heat-dissipating device 10, as shown in Fig. 1, mainly comprises a radiator 15 and a fan 11, wherein the radiator 15 comprises a heat-conductive base plate 151 provided with a plurality of fins 155 protruding therefrom, and an air outlet 153 may be formed naturally between each of the fins 155. Further, the heat-conductive base plate 151 is fixedly provided on the top surface of a chip, central processing unit (CPU), or electronic device 19, such that the high working temperature is generated as the electronic device 19 operates, may be transmitted to the heat-conductive base plate 151 and each of the fins 155 by means of heat conduction. Further, the fan 11 is disposed at the top side of the fins 155. When a motor 117 of this fan operates and controls the rotation of fan blades 115, cooling air may be introduced from an air outlet 113 and then blown toward the fins 155 for removing the high working temperature, having been conducted to the fins 155, to the exterior. Thereby, the high working temperature generated by the electronic device 19 may be reduced.

Referring to Figs. 2A and 2B, there are shown a diagram and a structural side view of the conventional heat-dissipating device, respectively. A cooling airflow A, generated by the rotation of the fan blades 115, is presented as a spiral mode, due to the fact that an axial-flow type fan 11 is commonly used as that fan in the conventional heat-dissipating device 10. Inevitably, this spiral airflow A may be collided with the fins 155 when the former flows toward the fins 155. As such, not

only degraded performance resulted from a hindered or degraded airflow, but also annoying working noise may emerge.

Moreover, the effect of heat-dissipation at the center of the heat-conductive base plate 151 is relatively poor and thus unattainable to its best performance of heat-dissipation, owing to the motor 117, which must be disposed at the center of the fan 11, and the formed spiral airflow. Further, it is impossible for the cooling airflow A to arrive at the bottom side of the fins 155 and the heat-conductive base plate 151, because the fan 11 is disposed at the top side of the fins 155. This may also significantly degrade the best performance of heat-dissipation.

For this reason, none of the industry is reluctant to invest vigor and cost in studying the improvement for the conventional heat-dissipating device, for instance, the new technologies disclosed in Taiwan Patent Publication No. 491519, entitled "Improvement For Fin Structure (III)", and in Taiwan Patent Publication No. 500302, entitled "Fin Structure", to overcome imperfections in present technology. However, for the disclosed technology in the aforementioned patents, there still exist following disadvantages:

1. It is still hard for the cooling airflow to arrive at the remote fins or the heat-conductive base plate, due to the fact that the fan is disposed at either the top end or the side end of the fins, so as to significantly degrade the best heat-conductive performance.

2. The spiral airflow may still hit against the fins because the axial-flow type fan is used, which results in not only degrading heat-conductive performance, but also generating annoying working noise.

3. The center of the axial-flow type fan is still not supplied with the cooling airflow, leading to degrading the best performance of heat-dissipation.

SUMMARY OF THE INVENTION

Accordingly, how to design a novel heat-dissipating device allowed for uniformly blowing the cooling airflow toward each of the fins and decreasing the probability of collision between the cooling airflow and the fins in order to achieve the effectively raised heat-dissipating performance and the reduced working noise is the key point of the present invention.

It is a primary object of the present invention to provide a heat-dissipating device capable of eliminating the imperfection in technology with which the conventional heat-dissipating device is confronted.

It is a secondary object of the present invention to provide a heat-dissipating device provided with a cross-flow type fan disposed within an accommodating opening formed by fins such that a cooling airflow generated by the cross-flow fan

may be uniformly blow toward everywhere of each of the fins in order for achieving the effectively raised performance of heat-dissipation.

It is another object of the present invention to provide a heat-dissipating device used with a cross-flow type fan for generating an approximately parallel cooling airflow with respect to fins in such a way that the probability of the collision between the cooling airflow and the fins may be effectively reduced so as to lower the working noise.

It is still another object of the present invention to provide a heat-dissipating device used for achieving the best performance of heat-dissipation by means of at least one heat-conductive pipe contacting with the center of a heat-conductive base plate, and facilitating the removal of the high working temperature at the center of the heat-conductive base plate.

For the purpose of achieving aforementioned objects, therefore, the main structure according to one preferred embodiment of the present invention comprises a radiator provided with a plurality of fins on a heat-conductive base plate, an air-outlet gap being naturally presented between any two of the adjacent fins, and an accommodating opening being disposed at an identical location on each of the fins; and a cross-flow type fan having a plurality of fan blades provided at a shaft plate, each of the fan blades being presented within the accommodating openings of the fins, in such a way that the airflow generated by the rotation of the cross-flow type fan is allowed for contacting with the fins and discharged through the air-outlet gaps.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a structural disassembled diagram of a conventional heat-dissipating device;

Fig. 2A is a diagram of an airflow path generated in the conventional heat-dissipating device when a fan rotates;

Fig. 2B is a structural side view of the conventional heat-dissipating device when the fan rotates;

Fig. 3 is a structural disassembled diagram of a heat-dissipating device according to one preferred embodiment of the present invention;

Fig. 4 is a perspective diagram showing the present invention after assembled;

Fig. 5 is a diagram of an airflow path showing the present invention when the fan rotates; and

Fig. 6 is a structural cross section view of a heat-dissipating device according to another embodiment of the present invention.

DETAILED DESCRIPTION

The structural features and the effects to be achieved may further be understood and appreciated by reference to the presently preferred embodiments together with the detailed description.

Referring to Fig. 3, firstly, there is shown a structural disassembled diagram of a heat-dissipating device according to one preferred embodiment of the present invention. As shown in this figure, a heat-dissipating device 30 of the present invention mainly comprises a radiator 40 and a cross-flow type fan (centrifugal fan) 50. In this case, the radiator 40 is provided with at least one heat-conductive pipe 41, for example, a U-shaped heat-conductive pipe in this embodiment, may be attached to a heat-conductive base plate 49. A bottom pipe 415 of this heat-conductive pipe is horizontally disposed at the center of the heat-conductive base plate 49 in a staggered manner, and whereby, the high working temperature of the heat-conductive base plate 49 attached to the surface of various electronic devices 39, such as central processing units, chips, etc., as examples, may be removed. Besides, two sides of the bottom pipe 415 are projectingly provided with upright pipes 413, respectively. Further, at least one through-hole 455 is chiseled through each of the fins 40, and then passed through by the upright pipe 413, correspondingly. In this manner, a plurality of fins 45 may be fixedly stacked on and contacted with the heat-conductive pipe 41, while between any two of the adjacent fins 45, an air-outlet gap 47 may be formed naturally. An accommodating opening 43 may be chiseled at an identical location of each fin 45.

Moreover, the cross-flow type fan 50 is provided with a plurality of parallel fan blades 55 at the bottom side of a shaft plate 51, and a diversion hole 57 is then naturally formed between any two of the adjacent fan blades 55. Further, the same as the fins 45, a top air inlet 53 and at least one second through-hole 59 to be passed through by the upright pipe 413 may be chiseled in place through the shaft plate 51. Besides, at a part of the top air inlet 53, a supporting stand 515 connected to the shaft plate 51 is provided for fastening a motor 517.

Additionally, referring to Fig. 4, there is shown a perspective diagram of the present invention after assembled. As shown in this figure, when assembling the device of the present invention, the heat-conductive base plate 49 of the radiator 40 is fixedly provided on the top surface of the electronic device 39, while each of the fins 45 is passed through at the first through-hole (455) thereof by the upright pipes 413 of the heat-conductive pipe 41, such that each of them may be stacked at different locations on the upright pipe 413, and presented as a parallel mode with respect to the heat-conductive base plate 49. Further, the cross-flow type fan 50 may be fixed at the top side of the fins 45 by means of the upright pipe 413 passing through the second through-hole (59) of the shaft plate 51, while the fan blades 55 and the motor (517) of

this fan may be naturally accommodated within the accommodating opening 43 of the fins 45.

In this embodiment, owing to the fixedly provided on the heat-conductive pipe 41, the fins 45 may be not contacted with the heat-conductive base plate 49 directly, which enables a bottom air inlet 435, presented between the fins 45 and the heat-conductive base plate 49, introducing the air into the operation area of the cross type fan 50 from outside. In this way, the cross-flow type fan 50 are thus provided with both of the top air inlet 53 and the bottom air inlet 435 for facilitating the raised efficiency of heat-dissipation.

Moreover, referring to Fig. 5, there is shown a diagram of an airflow path according to the present invention when the cross-flow type fan rotates. In the present invention, as shown in this figure, when the fan blades 55 of the cross-flow type fan 50 rotates, the gas G will be introduced into the operation area of the cross-flow type fan 50 from outside through the top air inlet 53 or bottom air inlet 55. Further, on operation of the fan blades, the cooling airflow A may blow toward the fins 45 in an approximately parallel manner with respect to the fins 45, and be discharged outside through the air-outlet gap 47 of these fins.

In this present invention, the cooling air A may be uniformly distributed over each fin 45, without the general problem in relation to the distance spaced from the fan in the conventional heat-dissipating device, due to the fact that the fan blades 55 of the cross-flow type fan 50 is positioned as a whole within the accommodating opening 43 constituted by each fin 45. Thus, the efficiency of heat-dissipation is effectively raised.

Furthermore, the probability of collision between the cooling airflow A and the fins 45 may be effectively reduced, due to the fact that the cooling airflow A, generated by the rotation of the fan blades, is contacted with each of the fins 45 in an approximately parallel manner. Thereby, not only the greatest efficiency of heat-dissipation, but also the reduced annoying working noise may be achieved.

Further, the high working temperature at the center of the heat-conductive base plate 49 is opportunely removed by the upright pipes 413 or individual fins 45 for facilitating the greatest efficiency of heat-dissipation, because the bottom pipe 415 of the heat-conductive pipe 41 may pass through the center of the heat-conductive base plate 49 in a staggered or horizontal manner.

Finally, referring to Fig. 6, there is shown a structural cross section view of the heat-dissipating device according to one embodiment of the present invention. As illustrated in this figure, a heat-dissipating device 60 of this embodiment mainly comprises a plurality of fins 65 fixedly provided on the heat-conductive base plate 49 directly or indirectly, and presented as a vertical angle or an inclined angle with

respect to the heat-conductive base plate 49. Again, an air-outlet gap 67 is naturally formed between any two of the adjacent fins 65, and an accommodating opening 63 allowed for accommodating the cross-flow type fan 50 is chiseled at an identical location of each fin 65.

Furthermore, a bottom strut 611, disposed at the bottom side, of the heat-conductive pipe 61 may contact with or directly pass through one side of each fin 65. For the purpose of raising the effect of heat-dissipation of individual fins 65 and facilitating the fixing of the cross-flow type fan 50, at least one strut may be horizontally provided on a connecting pipe 617 of the conductive pipe 61. In this embodiment, for example, this at least one strut is illustrated as an E-shaped structure, in which, except for the bottom strut 611, there are further provided with a central strut 613 and a top strut 615 near the center and the top side, respectively, equally allowed for passing through the first through-hole (455) at each of the fins 65 and the second through-hole (59) at the shaft plate 51.

As the fan blade 55 rotates, the cooling air G may be equally introduced from outside via two sides of the cross type fan 50, the accommodating opening (first air inlet) 63, and a second air inlet 635, as well as transformed into the cooling airflow A approximately parallel with the fines 45 in an axial-in horizontal-out manner, and then discharged through the air-outlet gap 67. Again, the effectively raised efficiency of heat-dissipation and the reduced working noise may be thus equally achieved.

To sum up, the present invention is related to a heat-dissipating device, particularly to a heat-dissipating device capable of cooperating with a cross-flow type fan, by which not only the significantly raised effect of heat-dissipation of a heat-conductive base plate, but also the effectively reduced working noise due to a parallel path of the airflow with respect to fins may be obtained.

The foregoing description is merely one embodiment of present invention and not considered as restrictive. All equivalent variations and modifications in process, method, feature, and spirit in accordance with the appended claims may be made without in any way from the scope of the invention.

LIST OF REFERENCE SYMBOLS

10	heat-dissipating device
11	axial-flow type fan
113	air outlet
115	fan blade
117	motor
15	radiator
151	heat-conductive base plate

153	air outlet
155	fin
19	electronic device
30	heat-dissipating device
39	electronic device
40	radiator
41	heat-conductive pipe
413	upright pipe
415	bottom pipe
43	accommodating opening
435	bottom air inlet
45	fin
455	first through-hole
47	air-outlet gap
49	heat-conductive base plate
50	cross-flow type fan
51	shaft plate
515	supporting stand
517	motor
53	top air inlet
55	fan blade
57	diversion hole
59	second through-hole
60	heat-dissipating device
61	heat-conductive pipe
611	bottom strut
613	central strut
615	top strut
617	connecting pipe
63	accommodating opening
635	second air inlet
65	fin
67	air-outlet gap